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This publication contains information regarding new developments of interest to agriculture based on laboratory and field investigations by the Du Pont Company. It also contains published reports of investigators at agricultural experiment stations and other institutions as related to the Company's products and other subjects of agricultural interest.



AGRICULTURAL NEWS LETTER

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Calluses and Culture



Culture and calluses — once thought a degree or two of education apart — are now a combination quite common, both in industry and on the farm. The rapidly rising standard of living in America has almost completely washed away the economic wall that formerly kept those who labored hard from expressing the deepest aspirations of the human spirit.

Once the enjoyment of the finer things of life was the exclusive province of the leisured well-to-do. A worker in a factory or the owner of a family farm worked long and exhausting hours, then crept with great fatigue to an early bed. Sundays and the rare holiday found them able to do little more than recoup their physical energies.

In this age, however, shorter work weeks and greatly enlarged incomes have been made possible by several decades of steadily rising productivity, in industry and on the farm. These benefits, in turn, have brought to farmers and to manufacturing employees ample

opportunities to discover the satisfying pleasures of good music, good books, and good magazines; and have permitted travel to historic shrines and natural wonders of the American scene.

Melodies and Books

Many a small civic orchestra boasts a grain grower who spends his Tuesday evenings with a 'cello gripped between his knees, or a skilled machinist whose hands, commonly attuned to a lathe, evoke complex melodies by arching a bow across the strings of a violin. The rural postman frequently deposits in huge, bread-loaf-shaped mailboxes the newest selection of a monthly book club, or requested brochures that will help a farm family plan their prospective vacation trip to Williamsburg, Virginia.

We recently met a young farmer who installed a home-crafted hi-fi rig in his dairy barn. (An unused straw chute, he claims, makes an unbeatable infinite baffle for an extended range speaker.) His thirty-six Holsteins, it seems, give down their milk best to well-modulated strains of a Schubert string quartet. "I've always liked country music, Nashville style," he insisted while watching white rivers of milk flow overhead through transparent plastic pipes to the milk house.

"But now that I have the time and the chance to listen," he added, "I'm beginning to like this long-haired stuff myself."

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Ripe strawberries, home-made biscuit, and whipped cream are the makings of the favorite dessert of millions of Americans. The decision as to how many portions of strawberry shortcake will be served on U. S. tables depends in large part on the cost. Many items of production enter into the cost of growing farm products: machinery, fertilizer, labor, and pesticides. Here, as in many other areas, products of the chemical industry are one of the smallest cost factors in the market price.

For each 50 cents the housewife pays for strawberries, the farmer spent less than half a cent for protection against disease during the growing process. About three tenths of a cent is the cost of spray needed to control insects to bring a pound of apples to healthy maturity. Only two-tenths of a cent was the farmer's cost for chemical weed control in growing a basket of peas, and just a few hundredths of a cent provided pest protection for a peck of corn. The baker paid a fraction of a cent for mold inhibitor to keep bread fresh.

17 Cents for TV Screen

What is true of agricultural chemicals holds generally for most chemicals in useful consumer products. A television picture tube, costing \$25 to \$50, requires about 17 cents' worth of chemicals to create the screen on which the electronic beam makes a picture. The refrigerant for safe home refrigerators adds some 25 cents to the production cost of each unit.

The sulfuric acid in one car or truck battery brought manufacturers, like Du Pont, about three cents in sales volume. Just a few mills bought the tetraethyl-lead anti-knock compound in a gallon of gasoline — without it high-compression engines could not function.

One Cent for Fishing Rod

The farm housewife's nylon hose expenses include about 12 cents for the nylon, while her dress (as well as her husband's new Sunday suit) are dyed with 15 cents' worth of coloring materials. Bleach to make a week's washing sparkle costs seven tenths of a cent.

On the recreation side, it takes only one penny to buy the bonding agent in glass fiber laminates for fishing rods. An oilless shutter drive gear, using less than a cent's worth of nylon, keeps a home movie camera running in cold weather, when ordinary lubrication

from shortcake
to sunday suit

CHEMICALS DO BIG JOB BUT ADD LITTLE TO PRODUCTION COSTS

would slow down smoothness of operation. Transistors that make possible lightweight radios and TV sets, and hundreds of electronic products, use silicon costing seven cents — although transistors may cost \$5 to \$50.

Greater Yield

The cost of chemicals is only one side of the coin. The additional value they create is often far greater. In farm chemicals, the return in increased production is usually much greater than the cost of chemical and application. A 3.5 pound yield increase per cherry tree "would pay for all the chemical control measures for the cherry fruit-fly. Without control the crop cannot be sold," according to a report from Oregon State College.*

The study also points out that 50.8 pounds more wheat per acre pay for chemical tarweed-mustard control; 13.6 pounds more of clover is equal to chemical control cost of midge and lygus; 58.8 pounds of peas pay for cost of weevil control; while aphids, flea beetles, and leaf hoppers are controlled by chemicals costing the equivalent of 120 pounds of potatoes per acre. In most cases, these increases in output are surpassed through the use of pesticides, thus completely covering cost of application and adding a profit. A report from Colorado points out that for every dollar spent in the State for insect control, farmers realized a return of \$23. Growers of potatoes, tomatoes, wheat, lettuce, corn, and beans spent \$1,084,000 to prevent insect damage, gaining an estimated \$23,368,000 in undamaged crops.

*Jernstedt, M. L. and Mumford, D. C., "Economic Aspects of Pesticide Application," *Charges for Commercially Applied Pesticides*, Station Bulletin 566, January, 1958, p. 14.

SOIL FUMIGANT for CONTROL of CLUBROOT

by R. C. CETAS, Ph. D.*
Department of Plant Pathology
Cornell University

A relatively new soil fumigant containing 31 per cent sodium methyl dithiocarbamate (VPM) has proven effective for control of clubroot of crucifers on Long Island. Satisfactory control of weeds and of clubroot resulted from drench applications and from broadcast and band treatments with soil-fumigant applicators.

The chemical was applied to soils that were prepared for seeding or for transplanting. The soil temperature was above 60°F in all cases. The soil surface was sealed with 1 to 1.5 inches of water applied by overhead sprinkler irrigation or other convenient methods. The amount of water used varied with the moisture content of the soil. The soil was treated about one month before the seeds were sown or before the plants were set. A waiting period of two to three weeks is, however, usually sufficient. The soil was shallow harrowed a few days before seeding or transplanting. When the VPM soil fumigant was applied with a soil fumigant applicator, it was injected five to six inches. The shanks on the shank applicator were spaced six inches apart. The shanks must be set this close because the chemical does not move as far laterally in the soil as do nematocides, e. g., DD or EDB. All tests were conducted on Sassafras loam and Sassafras

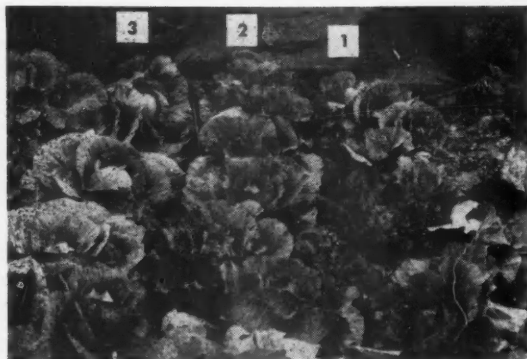
sandy loam soils.

Drench applications of one quart of fumigant per 100 square feet applied to beds subsequently seeded to Chinese cabbage, cabbage, and cauliflower have resulted in satisfactory control of weeds, clubroot, and wirestem. In 1956, only one Chinese cabbage plant of 165 examined from the plots treated with one quart of fumigant per 100 square feet had clubroot, whereas 56.5 per cent of the plants examined from the nontreated plots were diseased. No clubroot was found on the Chinese cabbage plants from beds treated with 1.5 and 2.0 quarts of VPM per 100 square feet. In 1957, 50 per cent of the cabbage and cauliflower plants harvested from nontreated plant beds had clubroot but only 20 per cent of those harvested from beds treated with one quart per 100 square feet were diseased. Some of the plots in 1957 probably were recontaminated by surface drainage water, and as a result, clubroot developed on a number of plants.

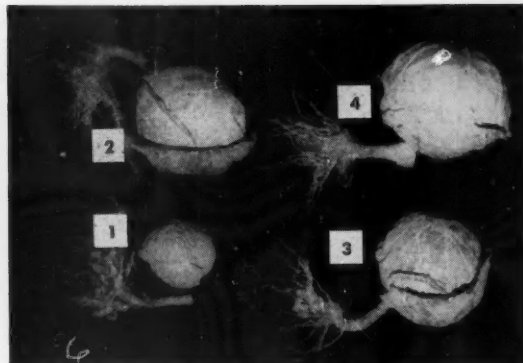
Satisfactory Plant Growth

Broadcast injection treatments of one quart of VPM per 100 square feet has resulted in a reduction in the incidence and severity of clubroot, satisfactory plant growth, and good weed control. In one test, the cabbage heads harvested from the treated plots averaged 4.3 pounds but those from the nontreated plots averaged only 1.2 pounds. In this test, 94 per cent of the plants examined in the treated plots

*Long Island Vegetable Research Farm, Riverhead, N. Y.



CABBAGE PLANTS grown in non-treated soil (1), and in soil given band treatments of VPM at rates of one pint (2),



two pints (3), and three pints (4) per 100 feet of row, applied with one, two, and three shanks, respectively.

and 97 per cent in the nontreated ones had clubroot. But, the clubs were on the taproots of most plants from the nontreated areas and mainly on the lateral or secondary roots of the plants grown in the treated areas. Thus, the disease was less severe in the treated plots than in the nontreated ones. This, of course, permitted satisfactory plant growth in the treated plots.

In a second experiment, 100 per cent of the cauliflower plants grown in nontreated soil had clubroot, but only 60 per cent of the plants from the treated soil were diseased. Here again, the disease was more severe on the infected plants grown in the nontreated plots than on those grown in the treated ones. As a result, about 60 per cent of the plants in the treated plots produced marketable heads, but the heads were harvested from only about 12 per cent of the plants in the nontreated plots.

Excellent Control

Band treatments of one pint of VPM per 100 feet of one-row raised beds has given excellent control of weeds in the row and of clubroot. In this test, one shank of a shank applicator was used to apply the chemical to each row. This method of application controlled all

weeds in a 16-inch band on top of the bed. Danish Ballhead cabbage plants set in the treated band of soil produced heads that averaged 2.5 pounds each. In contrast, plants set in nontreated beds produced heads averaging only 1.1 pounds. Clubroot developed on only 6.5 per cent of the plants in the treated bed but on 96.8 per cent of the plants examined from the nontreated row (see illustrations).

The drench or broadcast injection applications of one quart of VPM per 100 square feet are too expensive for field use. This dosage is equal to 108 gallons per acre or about \$400. It is not, however, too expensive to use in cold frames, hot beds, or field plant beds for the control of weeds and of diseases caused by soil borne pathogens. The band treatment of one pint of VPM per 100 feet of row, on the other hand, is not too expensive to be considered for field use, especially where weeds and clubroot are a problem. It is estimated that this treatment will cost between \$75 and \$90 per acre. There are indications that one-half pint per 100 feet of row may prove effective. If so, cost of the band treatment will be much less than indicated above.

FFA Chapter Undertakes Commercial Seed Treatment

At a time when juvenile delinquents often make the headlines, the story of 38 boys in an Oklahoma Future Farmers of America chapter points up the fact that American youngsters of today still have resourcefulness and drive to earn their way by working.

It was a little over 10 years ago that the boys decided to undertake a business venture to raise money for chapter activities, not simple jobs that kids might normally do, but the skilled task of treating seed for the local farm community. Since no seed-treating facility was available in the Cordell, Okla., area, the chapter felt this was not only a means of raising funds but an opportunity to educate themselves and the farmers to the value of something new.

In 1947, the Cordell FFA purchased a seed treating and cleaning machine in cooperation with the veterans' agriculture class of its school. The boys were trained in the processing technique by their chapter advisor and

teacher, Jack Harper. During the first year, 3000 bushels were handled and \$750 was raised. In 1948, production jumped to 13,000 bushels, and now 115 farmers are served in a 10 square-mile area. "Ceresan"* seed disinfectant is used and the charge for cleaning and treatment is 10 cents per bushel.

Approximately 30 per cent of the chapter's financial needs have been met from the proceeds of seed treatment. Proceeds from the first season were almost enough to pay for a pickup truck. Since operations began, the original equipment wore out and one new cleaning and a treating machine have been purchased. Some 150 boys have been trained to operate the machines since 1947.

In addition to seed treatment, the chapter also raises funds through cattle spraying, digging cactus out of pastures, and applications of bindweed killers.

*Du Pont trademark.

theories of

APPETITE CONTROL

by F. W. HILL, Ph.D.*
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One of the enigmas of nutrition which is of fundamental importance in feeding all animals, including man, is the mechanism which governs the voluntary intake of food. What is the signal that stimulates the animal to eat? And by what means does the animal know when it has eaten enough? These questions are of particular importance in farm animal and poultry management since *ad libitum* feeding is usually practiced and it seems likely that one of the basic differences in feeding programs may lie in their effects on voluntary food intake.

Earlier ideas of food intake control were based on the belief that the lowering of blood sugar which develops between meals stimulated stomach contractions, producing hunger pains which motivated the animal to eat. This explanation was inadequate because (a) cutting the nerve supply to the stomach stopped hunger pains but did not abolish appetite, and (b) removal of the stomach also abolished hunger contractions but did not materially influence food intake.

Specific Brain Centers

Beginning in 1940, investigations at Northwestern and Yale Universities showed clearly that specific centers in the brain control food intake. Precisely placed surgical damage in the medial hypothalamus caused animals to increase enormously their food intake (hyperphagia), whereas damage to the lateral hypothalamus resulted in a complete refusal to eat (aphagia). If both parts of the hypothalamus were damaged in the same animal, no eating occurred, indicating that the motivation to eat required normal functioning of the lateral center. The extreme fatness of rats with medial hypothalamic lesions was shown to be due simply to overeating. It was recognized that the two centers operate independently: Over-eat-

ing could be produced either by stimulating the feeding center (lateral) or inhibiting the satiety center (medial), or food intake could be reduced or abolished by stimulating the satiety center or inhibiting the feeding center.

While most of the information on hypothalamic control of food intake has been obtained by surgical lesions, another means of producing hypothalamic damage leading to overeating and obesity is by administration of gold thioglucose.

Three Major Theories

There are three major theories on the regulation of food intake, all of them consistent with the known functions of the hypothalamus.

Glucostatic Theory. This mechanism relates appetite and satiety to the level and availability of blood sugar. In particular, it considers that the difference (Δ glucose) in the amount of sugar in arterial and venous blood indicates the rate at which it is being used by body tissues. When Δ glucose is high, hunger is absent; when Δ glucose diminishes, hunger returns. This has been shown to occur in humans on ordinary diets. The idea also is supported by studies with rats in which injected glucose reduced food intake by an amount greater than the energy of the glucose; other substances such as fat and sucrose did not.

Thermostatic Theory. This theory considers that food intake is regulated as one means of temperature control. It is supported by experiments with rats fed diets differing in fat and protein content in which the amounts of food eaten appeared to produce from all diets a relatively constant specific dynamic action (extra heat production associated with eating). Also supporting this theory is the lowering of food intake which occurs when environmental temperature rises. It is known that the hypothalamus is concerned with temperature regulation through centers different from those associated with food intake, and it is postulated that the hypothalamus "integrates" the effects of temperature and circulating metabolites to control food intake.

*Condensed from *POULTRY COMMENT*, Vol. 14, No. 2, Fall, 1957, published by E. I. du Pont de Nemours & Company (Inc.), Grasselli Chemicals Department.

Lipostatic Theory. This theory, concerned primarily with long-term regulation of food intake, suggests that the state of fat stores of animals governs their rate of food consumption. This point of view is more a working hypothesis than a completely thought out theory at the present time, but it helps to explain why there appears to be a "privileged body weight" characteristic of the animal, the environment, and the feeding program.

None Explains All Aspects

Each of these mechanisms has shortcomings. The glucostatic theory is unable to explain the appetite satisfying value of a high protein diet. Work at Cornell showed that the satiety values of different diets for humans do not agree with their effects on blood glucose. In particular, the highest satiety value in reducing diets

studied with young men was obtained with a diet high in protein, high in fat, and low in carbohydrates; the poorest satiety was observed with a diet high in carbohydrate and low in protein. The effects of these diets on blood glucose were exactly the opposite of that which would be expected in the glucostatic theory. The thermostatic theory helps to explain the effect of protein, since this nutrient has a high specific dynamic action, but is not able to account for the effects of thyroxin, which increases both body temperature and food consumption, and some of the effects of hypothalamic damage.

Integrating these various views is difficult, but it appears that each of them has value and that none of them is capable of explaining all aspects of appetite.

Ziram and Ferbam Control Peach Leaf Curl in California

In tests conducted during two years, late fall applications of ziram and ferbam were highly effective in controlling peach leaf curl. Ziram was significantly better than basic copper sulfate, and ferbam and ziram appeared to be at least as effective as Bordeaux mixture. Nabam (tank mixed with metallic sulfates) gave about the same degree of control as the copper materials, but appeared to be somewhat less effective than either ziram or ferbam. Adhesive oils did not significantly increase the efficiency of either ziram or captan. None of the materials appeared to be phytotoxic. All of the materials markedly reduced the amount of leaf curl as compared with the unsprayed trees.

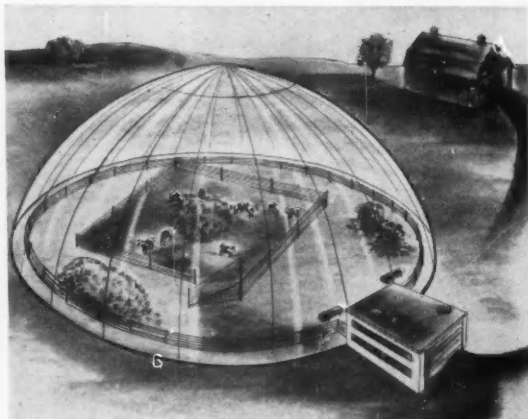
"Zerlate"* ziram fungicide provided outstanding control during both years. "Fermate"* ferbam fungicide, applied only with an adhesive oil, was almost as effective as "Zerlate". There was a suggestion that adhesive oils slightly improved the efficiency of "Zerlate" but the differences were not significant. Effective control was obtained in applications made with an air blast sprayer at 350 gallons per acre and with a hand gun at 500 gallons per acre. There was no evidence of phytotoxicity from any of the treatments. On the basis of the present

work and work reported from New York, it appears that several organic compounds, when used in late fall applications, are at least the equivalent of Bordeaux mixture in controlling peach leaf curl. Furthermore, at present prices some of the effective materials would be considerably less expensive than the copper compounds. — DEPARTMENT OF PLANT PATHOLOGY, UNIVERSITY OF CALIFORNIA.

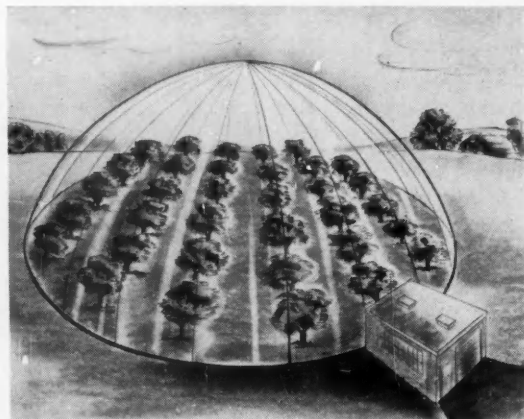
BOOKLET ON MODERN U. S. CORPORATION IS AVAILABLE

More than any organization in history, the large industrial corporation has demonstrated the "ability to bring people everywhere the technology and the gains of modern life," according to "This Is Du Pont," a booklet published recently by the Du Pont Company. This 52-page booklet tells the story of industry's role in the modern American society, of which it is an inseparable element, and relates the development of industry with the growth of the nation — using the 156-year-old Du Pont Company for illustration. A copy may be obtained free from: Editor, Agricultural News Letter, Du Pont Company, Wilmington 98, Delaware.

*Du Pont trademark.



AIR-SUPPORTED structure may someday be used to cover large sections of farm, providing shelter for buildings or animals.



ENTIRE ORCHARD might be covered with plastic "bubble" for the control of temperature, climatic conditions, or pollination.

DESIGN AND USE OF AIR STRUCTURES

Since the day some ingenious caveman set up a pole to hold up the roof of his home, man has sought better and cheaper means of construction. Development of modern plastic films and synthetic fibers has made it possible to use the air itself for supporting a wide variety of buildings.

Although the idea of air structures was suggested in England shortly after World War I as a means of providing military storage facilities, the practical application dates from the development of U. S. radomes about 10 years ago. The radomes, which house the radar antennae that protect the North American continent against enemy surprise attack, are made of coated fabric, spherical in shape, that is supported by low-pressure air blowers. They are located in many areas where conventional building would be faced with insuperable odds — such areas as the far north of Canada where the only access is by aircraft.

Strong Material Needed

The major problems in creating air structures are the strength of the material, the proper aerodynamic design to resist pressure from high winds, and good ground anchorage. "Mylar" polyester film is suitable for many types of air structure, because it provides both high strength and low weight. Sim-

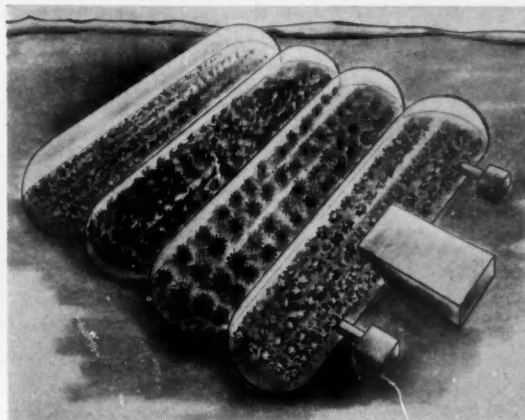
ilarly, successful pneumatic structures have been built with fabric of nylon and "Dacron" polyester fiber coated with neoprene or "Hypalon" synthetic rubber.

Wind-tunnel tests, as well as practical applications, have been made to determine the performance of various air-structure configurations. The shape most commonly employed commercially is that of a semi-cylinder with spherical ends. This type provides greatest floor space and has the advantage of being subjected to lower impact pressure than the radome silhouette. Proper patterning is important in order to avoid severe stress concentration which might tear the fabric.

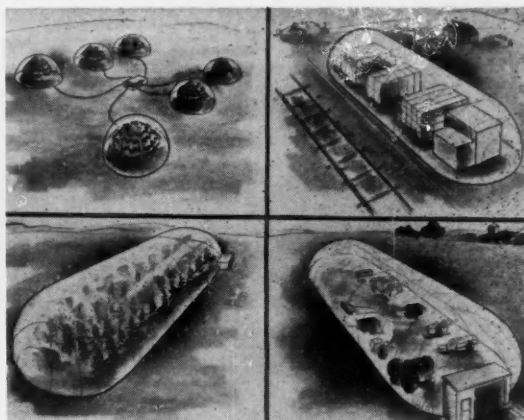
Positive Anchoring

Probably the most important single consideration of air-structure design is the anchoring, because all loads are upward at the base attachment. If not properly anchored, the base will pull loose, pressure will escape, and the structure may collapse, with possible damage. Experiments have been made with sand, water, and physical anchoring for the base. Fluid material — and even sand — has a tendency to "creep" since it will run away from the area of highest load. Positive ground anchoring has been found the most suitable means of providing base stability.

Support of structures is simple, since the



AIR STRUCTURES connected in tandem, provide greenhouses for several varieties of plants at reduced cost for blowers.



INDIVIDUAL STRUCTURES that are easily portable have many potential uses on farms to protect plants, supplies, or machines.

air pressure required is relatively low and can be supplied by blowers of low capacity. The comparatively low cost of anchoring and fabric makes possible construction of air structures in many farm applications at costs far below conventional materials. Many applications heretofore economically unjustified with regular buildings can become practical with pneumatic buildings. Air structures also provide the additional advantage that they can be dismantled in a few hours and transported in a truck to a new site.

Covering Entire Buildings

A study by the Construction Division of the Du Pont Company showed that an air structure of about 3,200 square feet could be erected at the cost of a cheap pole building. The expected life of the pole building with the frequent moves usual in the construction business was four years, while that of a pneumatic shelter was seven years. But, if the shelter is moved once, the saving in the air structure is equal to more than half its cost, so that two moves cancel out the entire cost.

Thus far, air structures have found their major civilian applications in shelters and warehouses. An experimental pneumatic greenhouse of "Mylar" has been built at Cornell University. Many potential uses have been designed; some have had experimental applications. Advances in design of structures and improvement in materials will provide an almost unlimited field of application. Experi-

ments suggest that "Mylar" could be used for a structure of 200 feet or more in diameter, sufficient to cover entire farm buildings or substantial crop-growing areas. Some of the potential uses, as designed by Du Pont engineers, are shown in the illustrations.

DAIRY FARM EFFICIENCY RISES WITH HERD SIZE

It takes almost 129 hours during the year to care for each cow in a 10-cow herd, while only 80 hours per cow are required in a 30-cow herd, according to a one-year study by USDA and University of Minnesota research economists. For a 15-cow herd, the economists found that 23.7 man-hours are required weekly in the summertime and 35.2 per week in winter. For a 20-cow herd, 27.9 man-hours are needed weekly in summer and 41.6 in winter. During summer, each extra cow above 15 required .83 hour of care per week, well over half of which time is needed for milking.

One means of saving time is to use a milking parlor, which is a time-saver in itself and also makes possible installation of a pipeline milker at much lower cost than in a stanchion barn. In winter, an extra cow above 15 requires 1.27 man-hours weekly, the longer time being due to a number of reasons. The best opportunity for reducing labor in winter seems to be with such labor-saving devices as silo unloaders, gutter cleaners, and storage of baled hay near the feeding racks.

new PRODUCTS AND APPLICATIONS

"Viton" synthetic rubber, a new fluorine-containing elastomer, will soon be produced by Du Pont in a plant nearing completion. It has greater resistance to oils, fuels, and solvents, at temperatures over 400°F than other available commercial rubber products and represents a major breakthrough in elastomer chemistry. Although the major application currently is in military aircraft and missiles, its properties make "Viton" useful in farm machinery, trucks, protective clothing, and insulation.

* * * * *



A neoprene-coated tank that looks like a big tooth-paste tube is being used to haul molasses to feed mills and cattle feed lots at lower cost. When emptied, the 3800-gallon tank is simply rolled up and stored in the forward section of a trailer truck, with the truck space used to carry grain or cattle on the return trip. Because neoprene resists oil and chemicals, many other uses are practicable. The tank might be used to haul water for farm animals or farm chemicals, or serve for temporary storage of liquids. (Manufactured by U. S. Rubber Co., Providence, R. I.).

* * * * *

A new insect repellent, offered by Du Pont, keeps off mosquitoes, gnats, ticks, chiggers, flies, and other biting insects for periods up to eight hours. It is non oily and safe for application to skin and most clothing fabrics. Based on N,N-diethyltoluamide, described as the most effective insect repellent developed, the product is available as a lotion or as an aerosol spray.

Chemicals in Spray Cans Make Home Gardening Easier

Home gardeners who want to protect their plants against the onslaught of warm-weather bugs, but dislike the job of mixing insecticide and fungicide solutions for mechanical spraying, have a wide choice of clean, easy-to-use aerosol products to spray away their problems this season.

Dozens of different types are available, with formulations designed to control just about every type of plant pest. Although not economical for the big-scale gardener with hundreds of plants, the aerosol sprays are an effective time-saver for the person with a few

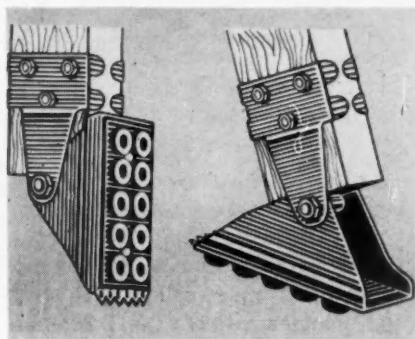
choice plants, or for use as a spot emergency control measure between regular sprayings. They are particularly useful in treating indoor plants, for they offer an easily controlled spray.



Label directions should be followed closely when using any of the spray products. Normal precautions against excessive inhalation of the spray or use around foods, animals, fish bowls, or bird cages should be taken. Most plant sprays, because they contain petroleum derivatives, should not be sprayed into or near open flames and in no case should empty aerosol containers be incinerated.

A new plastic film, whose superior outdoor weathering characteristics may make it suitable for greenhouses and other farm structures, is under development by Du Pont. A laboratory sample has been exposed in Florida for 10 years without discoloring or becoming brittle. The film is clear and colorless. It has high mechanical strength, excellent resistance to chemicals, transmits ultraviolet light, and retains its properties through wide temperature range. It is based on a new polymer not commercially available; further evaluation of manufacturing and markets is required before a decision on production can be made.

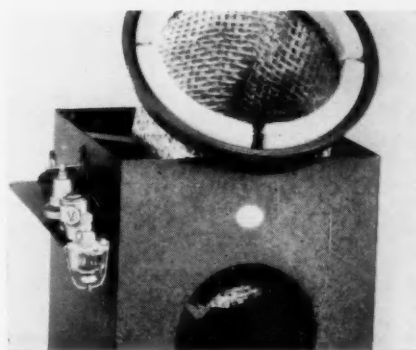
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Safety ladder shoes that prevent slipping indoors or out can help reduce farm accidents. The shoes, which have been approved by Underwriters' Laboratories, have a surface equipped with neoprene treads for a sure grip on slippery floors. The reverse of each shoe has a spiked toe that digs into the ground to anchor the ladder so that it can be safely used for outdoor work. Neoprene is resilient and it is not affected by greasy or oily surfaces. The hinged safety shoe fits any standard ladder rails. (Manufactured by Dayton Safety Laboratories, Cincinnati 6, Ohio).

* * * * *

Farmers will be interested in a new humidifier which automatically controls home moisture and is available for attachment to existing heating systems. The "Air-Heet" unit contains a woven sponge-yarn basket — the material used in sponge mops — which absorbs 20 times its weight in water from a trough at the top. Warm air from the furnace moving through the basket picks up moisture, raising comfort level and decreasing chances of colds due to excessive dryness. A humidistat permits adjustment of comfort level. (Manufactured by Air-Heet Corporation, Chicago, Ill.).



New Fertilizer Formulation Is Announced by Du Pont

A new formulation of "Uramite" fertilizer compound — "Uramite" M — designed specifically for blending into mixed fertilizers is now being introduced commercially by Du Pont's Polychemicals Department.

"Uramite" M has such properties as high nitrogen content (38 per cent), gradual nitrogen release rate, and greatly improved safety for growing plants. It can be used in either the dry mixing or ammoniation processes, with these advantages in mixed fertilizers:

1. It provides plants — turfgrass, flowers, shrubs, and other ornamentals — with a continuous, uniform supply of nitrogen.

2. Its high content of gradually released nitrogen offers more concentrated and safer mixtures.

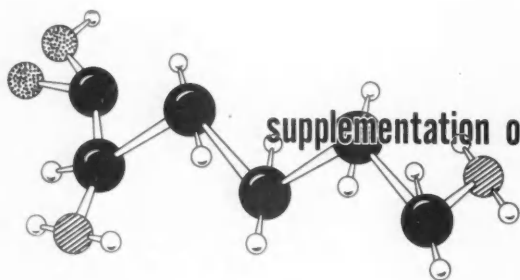
3. A free-flowing material, it blends well

with other ingredients to form a high quality mixed fertilizer.

4. It is manufactured in a particle-size designed for specialty mixes.

5. Application costs are reduced with its high nitrogen content, since fewer applications are required.

In addition to "Uramite" fertilizer compound, Du Pont produces "Uramon" ammonia liquor-37, an ammoniating solution which supplies one-fifth of its total nitrogen in long-lasting form. With UAL-37 and "Uramite" M, manufacturers can now make mixed fertilizers with almost any specified nitrogen content or physical appearance. These products, used alone or together in fertilizer manufacturing processes, provide a wide variety of desirable properties.



supplementation of foods with AMINO ACIDS

By HANS R. ROSENBERG, Sc.D.*
 Manager, Nutrition Section, Stine Laboratory
 Grasselli Chemicals Department
 E. I. du Pont de Nemours & Co. (Inc.)

The main sources of protein for man are without any doubt the cereals. Among these, the most important ones are wheat for the main segment of the population in our United States and in Europe, rice for the peoples of Asia, and corn for a great percentage of the inhabitants of Central and South America and Africa. By calculation, the first limiting amino acid in the protein of all three cereals, wheat, rice, and corn, is lysine. Yet, there are essentially no data available which would indicate whether or not lysine supplementation would have any significant effect upon the people consuming these cereals.

Effect in Food

Since people eat neither wheat kernels nor flour, we turned our attention to the form in which wheat is most often consumed, namely, bread. Secondly, we studied the effect of small graded doses of lysine added to a diet consisting only of bread plus the minerals and vitamins necessary for optimum growth. With the weanling rat, maximum response was obtained when about 0.4 per cent lysine was added to the 0.3 per cent lysine present in bread. The maximum response was similar to that obtained with the stock diet, indicating that under the conditions of this test, lysine was the only limiting amino acid in bread.

Particularly important was the observation that supplementation with a much smaller amount, about 0.25 per cent L-lysine-HCl, gave a growth response which, although sub-optimal during the first few weeks after weaning, permitted the animals eventually to reach a stature which was not much different from that obtained with optimum supple-

mentation. Curiously enough, the total amount of lysine in bread thus supplemented is of the same order of magnitude as found in whole wheat. Inasmuch as it is now recommended that this small amount of L-lysine-HCl, 0.25 per cent of the amount of flour, be added to improve the protein quality of bread, it may be justified to speak not only of supplementation but also of restoration of the nutritive qualities whole wheat possessed before milling.

We have carried out many additional experiments. For example, we have conducted a reproduction and lactation study with rats comparing the effects of commercial bread containing 6 per cent milk solids with the identical bread supplemented with 0.25 per cent L-lysine-HCl based on the weight of flour and baked into the bread, and with our stock diet. From many observations over a three-year period, on the parent generation as well as on six successive generations (involving ultimately several thousand animals) it was obvious commercial bread as the only protein source did not support adequate reproduction.

Symptoms of Deficiency

There was a reduced rate of conception as well as poor lactation, resulting in very low body weights at the time the animals are normally weaned (Figure 1). Some symptoms of lysine deficiency were exhibited which had

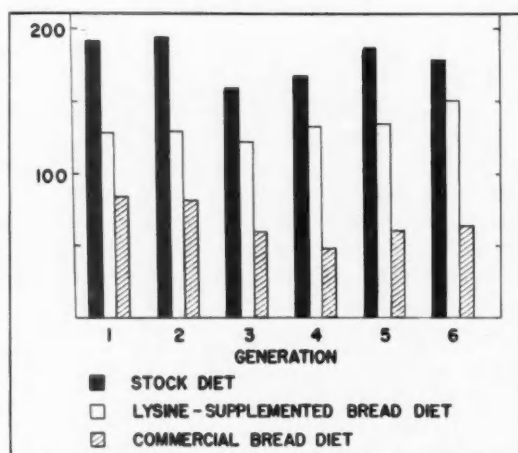


FIGURE 1. Nine weeks' weight gain (in grams) of six successive generations of rats on commercial bread diets.

*Excerpts from a report before the Food and Agriculture Division, American Chemical Society, April 16, 1958.

not previously been observed, including nervousness, irritability, anorexia, and perverted appetite. The rats chewed on everything they could reach and ate their own hair, thus denuding those parts of their body which they could reach. The hair accumulated in their stomachs and, upon death, hair boluses were found in the stomachs of all animals on the commercial bread diet. No such hair boluses nor any of the other symptoms were seen in the animals living on lysine-supplemented bread. This craving for protein, as evident from the chewing of their own hair, disappeared as the animals grew older and heavier. As maturity was reached, the rat's requirements for lysine decreased and the hair grew back giving essentially normal appearance.

Rice is the basic daily diet of more than half the human race. A number of investigators tested the effect of supplementing rice with the total, relatively large, amount of lysine considered to be the requirement on a normal diet and found no beneficial effect. Our studies followed the pattern used in bread diets: We used cooked or precooked rice.

Supplementation of Rice

Supplementation with 0.025, 0.05, and 0.1 per cent L-lysine-HCl gave increasing growth responses. The largest amount, 0.1 per cent, corresponding to 2 pounds of L-lysine-HCl per ton of rice, gave, after five weeks, an improvement in gain of about 40 per cent, and in a special study with selected litter mate males, the rats experienced a 100 per cent improved growth rate (Figure 2). After

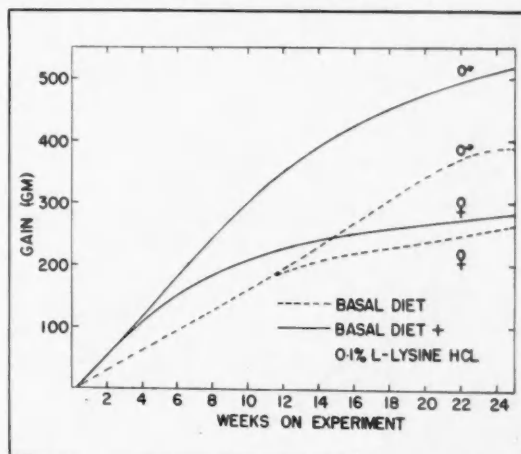


FIGURE 2. Growth of rats fed diets of white precooked rice and rice supplemented with 0.1 percent L-lysine-HCl.

25 weeks, only the animals on the properly supplemented rice diet had grown to essentially normal body size. These data certainly suggest that lysine supplementation of rice might be beneficial also to man. If lysine supplementation of rice should be found to be nearly as beneficial for men as for our laboratory animals, large scale supplementation would appear to be economically feasible, considering the relatively small amount of lysine needed. It is also important to note that protein and food efficiency are markedly improved by lysine supplementation of rice.

Public Health Measure

The third most important cereal is corn. Much research has been carried out with corn, and it is not easy to obtain a clear picture from the literature as to the possibilities for upgrading the corn protein by means of amino acid supplementation. The devastating protein deficiency disease Kwashiorkor is based to a large extent on the consumption of corn-containing diets. Consideration of all the facts involved suggests that lysine should be the first limiting amino acid, provided that sufficient niacin is offered so that all the tryptophan in corn can be used for tissue synthesis. This has, of course, been generally accepted; yet I have not been able to find in published form a convincing study of how proper lysine supplementation of corn might upgrade the nutritive value of corn. The results of a number of rat growth experiments suggest that lysine alone and in very small amounts, 0.025 per cent to 0.05 per cent, will improve a 90 per cent corn meal diet. Growth on this diet is poor, yet lysine improved the gain at five weeks up to 50 per cent.

Preliminary data suggest that children on corn masa experienced improved nitrogen retention when simultaneous lysine and tryptophan were supplied. If it can be shown that properly supplemented corn will reduce or prevent incidence of protein malnutrition, amino acid supplementation of corn might, in some countries, become a public health measure.

NOTE: In keeping with its policy of broadening markets through price reduction whenever possible, Du Pont reduced the price of L-lysine monohydrochloride by \$4 per pound (from \$12 to \$8 per pound), effective May 19, 1958.

Research Notebook



EARLY BLIGHT OF POTATOES IN SOUTHEASTERN IDAHO

Early blight of potatoes, caused by *Alternaria solani* Sorauer, although well known in many areas, has not been important in southeastern Idaho until recent years. Following the advent of sprinkler irrigation, early blight began to appear in scattered areas, varying from a trace to 50 per cent defoliation. During 1957, complete defoliation of the plants occurred in many fields which were irrigated by sprinklers, involving about 3000 acres. Frequent rains or heavy dews during periods of high temperature are essential for abundant sporulation and to provide water for germination of conidia. The sprinkler system of irrigation also appears

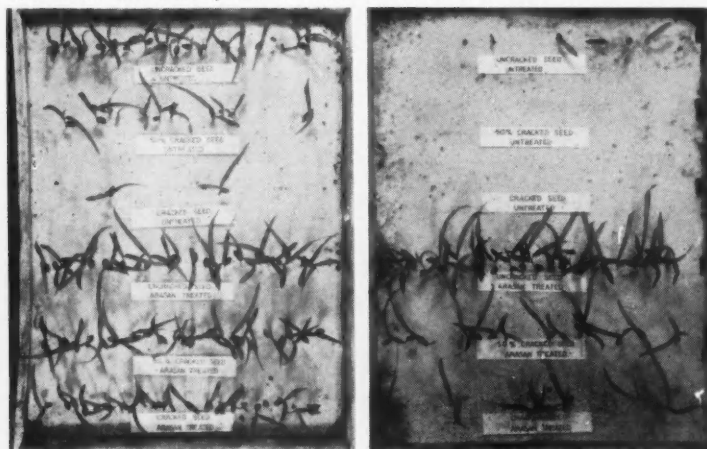
capable of providing the moisture for a severe epiphytotic, particularly during late July and early August, when the crop is frequently irrigated at five to seven day intervals. The destructiveness of this disease has been confined to defoliation. No confirmed cases of tuber rot have been observed. Sprinkler irrigation also complicated control measures, especially during July and August, a critical period of plant growth. Unless an adequate fungicide can be made to stick to the leaves, the foliage must be sprayed or dusted following each irrigation. So far, no attempt has been made to control this disease, but preliminary testing of fungicides is planned. — AGRICULTURAL EXPERIMENT STATION, UNIVERSITY OF IDAHO.

SEED TREATMENT IMPROVES SORGHUM STANDS

Poor stands of sorghum are often due to the attack of seed-borne and soil-inhabiting fungi. It appears that protecting the seed from attack by seed rotting fungi is necessary for good stands. In 1956, for three planting dates, the increase in stand from the use of fungicides was quite impressive, especially for the early planting. Twenty-five to 50 per cent of the possible germination seems to be lost in the field even when treated seed is planted. Many conditions could lower stands; one is cracked seed. Stands

from sound seed were twice as high as from cracked, averaging 80 and 40 per cent, respectively. In one test, stands decreased as the percentage of cracked seed increased. Improvements from seed treatment usually were greater as the amount of cracked seed increased. Tests were made when soil temperature was favorable for rapid germination.

Under less favorable conditions, the differences between cracked and uncracked seed should become greater. Under cold conditions and no treatment, stands from cracked and uncracked seed were very poor. With seed treatment, the stands from uncracked seed were nearly perfect, while those from cracked seed were better but still unsatisfactory. Under warm conditions, stands from uncracked seed, whether treated or not, were nearly perfect. Stands from untreated cracked seed were unsatisfactory, but they were nearly perfect when treated. Only sound treated seed could be expected to produce satisfactory stands under cool conditions. — AGRICULTURAL EXPERIMENT STATION, SOUTH DAKOTA STATE COLLEGE.



Photographs courtesy South Dakota State College.

Ureaform-New Turfgrass Fertilizer

A relatively new nitrogen fertilizer product now on the market shows promise of becoming the best lawn and putting green fertilizer yet developed. Called "ureaform," it is a compound of formaldehyde and urea.* Tests indicate ureaform fertilizers give growth response equal to or better than previously recommended fertilizers. They also maintain a steadier response through the growing season.

While turfgrasses, like other plants, need phosphorus, potassium, calcium, and other nutrients, nitrogen has long been considered the key factor in growth. Most turf fertilizers have relatively high nitrogen content, with adequate but lesser amounts of phosphorus and potassium. Trying to grow grass without adequate nitrogen has been compared to trying to run a motor without gasoline.

The ideal nitrogen turf fertilizer should break down gradually in the soil, becoming available steadily over a period of time, and one application a year should be enough — providing even, steady growth through the growing season. The ureaforms come closer to this ideal than any material in use.

Station turfgrass agronomists have worked with ureaforms for the past 10 years on lawns and putting greens and in seedbeds. As a result, they are recommending its use to all concerned with growing turf.

Ureaform is organic and contains 38 per cent nitrogen. It does not leach easily from the soil, and can be applied in recommended amounts without much danger of burning the grass. The material is odorless, is easy to handle and mix with other plant food materials, and it can be ground finely for application as a spray. It can be applied alone or mixed.

The turfgrass specialists recommend that ureaform be mixed with other materials to form a complete fertilizer for turfgrass growth. They have worked out a complete fertilizer with a 20-6-4 analysis. It contains 40 per cent, by weight, of ureaform, seven per cent urea, 35 per cent natural organic nitrogen material, 11 per cent triple superphosphate, and seven per cent muriate of potash. The urea provides a source of quickly available ni-

trogen for immediate plant response, while the natural organic nitrogen material provides several essential trace elements.

The research indicates that lawns need about six pounds of nitrogen per 1000 square feet when it comes from materials high in ureaform content. For putting greens, eight to 10 pounds per 1000 square feet is recommended. To do this, 30 pounds of the 20-6-4 fertilizer would be needed for lawns, and 40 to 50 pounds for putting greens. The study shows an annual application early in the season will do the job.

On seedbeds for turf planted in the spring, 20-6-4 fertilizer applied at eight pounds of nitrogen per 1000 square feet at seeding time will give excellent results. Less nitrogen caused turf quality to fall off later in the season, while higher rates caused injury. — AGRICULTURAL EXPERIMENT STATION, UNIVERSITY OF RHODE ISLAND.

INSECTICIDE-FUNGICIDE PROTECTS CUCUMBER AND SQUASH SEED

Tests on protectants against soil-borne insect and fungal pests of cucumber and winter squash seed showed that in most instances insecticide-fungicide combination treatments, regardless of dosage of the pesticides, gave better total stands than treatments with fungicide alone. All treatments of cucumber seed improved emergence in both fine sandy loam and in silt loam. Treatments containing an insecticide were more effective, in most instances, than those lacking an insecticide.

Results with fresh laboratory preparations of insecticide-fungicide were similar to those from commercial preparations. Plants from untreated squash seed and from treatments lacking an insecticide showed considerable injury by the seed-corn maggot. In fine sandy loam, about 40 per cent of the plants which emerged were injured when insecticide was not included. The plumule on many of the maggot-injured plants was injured to such an extent that the growing point was killed. Such plants did not develop beyond the cotyledonary stage. Dust and slurry treatment results were similar for both plants. — NEW YORK AGRICULTURAL EXPERIMENT STATION.

*Du Pont's trademark for ureaform fertilizer compound is "Uramite."

FUNCTION CONTROLS SIZE

TECHNOLOGY CHANGES PATTERN OF FARM PRODUCTION

The technological revolution in farming is rapidly bringing about changes in the average operating size of the productive unit in agriculture similar to those the industrial revolution wrought in manufacturing. More productive machinery, requiring sizeable investment in capital goods, has, as a rule, made essential an increase in the size of each unit — especially in terms of its volume of output.

In a free economic system, competition tends to force competing units to seek for more efficient operation. Farm machinery that does not work from “sun to sun” or plants that are not employed at capacity represent a loss in efficiency and a handicap in competition with more efficient units. A farmer might sell a horse that represents energy in excess of his needs, but he can’t spin off any of the horse power of his tractor. In areas where the needs of production are greatest and the investment in machinery highest — wheat, for instance — the economic principle that size is determined by function is most clearly illustrated.

More Large Farms

The trend is evident from the census findings* of 1950 and 1954. All classes of farms decreased substantially in number, except those in economic classes I (sales of \$25,000 per year or over) and II (sales of \$10,000 to \$24,999), which increased by 30 and 18 per cent, respectively. Today, economic classes IV and V (sales of under \$2,500) account for only nine per cent of the nation’s total farm sales, even though they constitute well over half the total farms in number. The minority of some 46 per cent produce 91 per cent of the farm marketing.

Some have expressed the concern that this pattern of farm marketing represents an unusual departure from the ideal socio-economic

structure. Actually, the pattern of “concentration” is characteristic of most institutions — social, religious, and economic — serving the needs of a large and wealthy population.

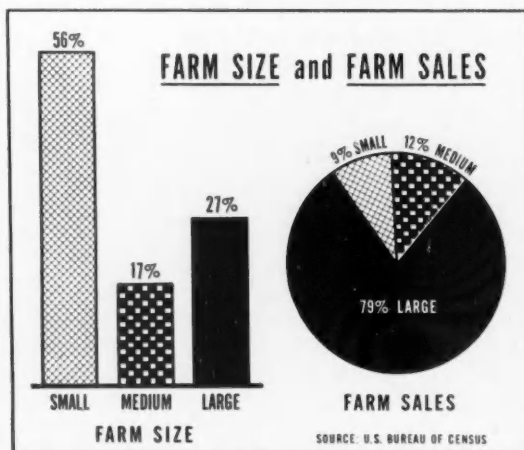
Growth in Education

In education, for example, the growth of large, multicurricular institutions is considered to be “one of the distinctly American contributions to higher education”† The nation’s 10 largest institutions of higher education (constituting barely 0.5 per cent of the total) enrolled 236,000 students, some 11 per cent of U. S. student bodies. Although one-fourth of the institutions in the country had from 972 to 33,870 students each, one-fourth of the students were in institutions enrolling over 10 times the minimum (9,948 or more).

One-third Belong to Six Unions

Over 98 per cent of U. S. church membership and 94 per cent of the churches belong to religious bodies with 50,000 members or more. Two Protestant denominations have 34 per cent of all adult church membership,

†Biennial Survey of Education in the United States — 1952-54, *Statistics of Higher Education: Faculty, Students, and Degrees 1953-54, Chapter 4, Section 1, U. S. Department of Health, Education, and Welfare, p. 10.*



COMPARISON OF the value of farm marketings with size of farm.

*U. S. Bureau of the Census. *U. S. Census of Agriculture: 1954. Vol. III, Special Reports, Part 7, Popular Report — The American Farmer in 1954*, U. S. Government Printing Office, Washington, D. C., 1956.

and about half of all Protestant membership.

Of the 189 labor unions listed by the Labor Department, six with membership of over 500,000 accounted for about one-third of the total union membership in the United States. The 146 unions with less than 100,000 members — although constituting over 77 per cent of the total — had only one-fifth of the membership. "Concentration of membership in a few large unions," the Department points out, "remains a characteristic of the labor movement."§

Unit Is Responsive to Need

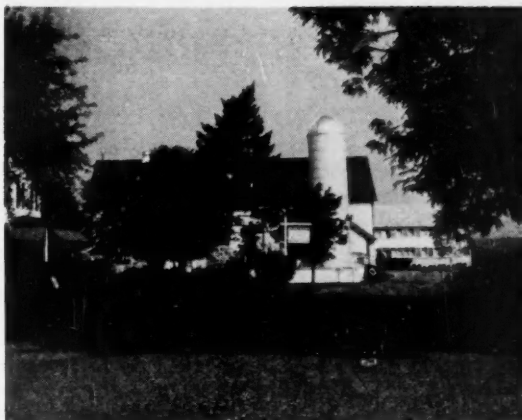
In the economic area, the picture is substantially the same, with the size of each unit responsive to the need it fulfills, the function it performs, and the operational efficiency it must meet. In manufacturing as a whole — an area in which investments vary from a few hundred dollars in a small job shop to many millions in a major auto plant — about one-third of the value added in manufacture is contributed by the 200 largest firms.

In the manufacture of tractors, which requires very large-scale assembly lines for economic operation, 94 per cent of shipments are made by the 20 largest companies, while the 20 largest firms account for only 60 per cent of all other types of farm machinery. In the making of signs and advertising displays, the 20 largest companies have only 15 per cent of shipments.

Economy Is not "Closed"

Although there is a tendency on the part of the more efficient unit to increase its share of the market, the productive establishment as a whole is far from "closed". New units are able to enter into all economic and social fields and very often replace those which no longer meet public demand or are able to exist in a competitive system. The 46 per cent of the farms which have 91 per cent of the market have no guarantee they will maintain their present position. Others, more efficient or more responsive to public demand, may take their market, just as often happens in industry.

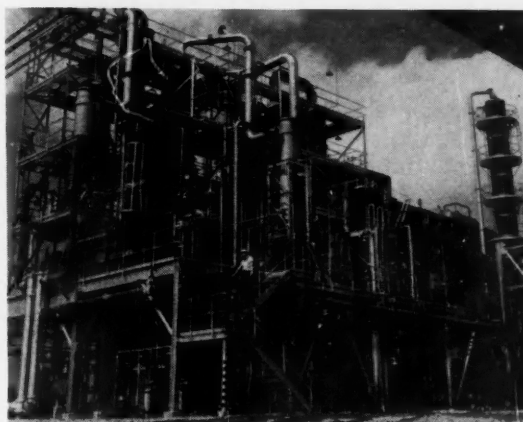
§Monthly Labor Review, Vol. 80, No. 10, October, 1957, p. 1202, U. S. Department of Labor, Washington, D. C.



46 PER CENT of the Nation's farms now produce 91 percent of total farm marketings, remainder only nine percent.



TEN LARGEST institutions of higher education, constituting only half a percent of the total, enroll 236,000 students.



UNIT OF production in manufacturing also follows economic rule that size of unit is determined by the job it does.



STUDY DEVELOPS IMPROVED MUSHROOM MARKETING

By ALBERT S. ALLEN
Film Department
E. I. du Pont de Nemours & Co. (Inc.)

Fresh mushroom consumption is being expanded rapidly through better packaging and other marketing improvements. Supermarket customers today find packaged mushrooms attractive and convenient. They consider this method of merchandising superior to the bulk retailing of recent years. Development of improved mushroom marketing methods originated at the College of Agriculture, University of Delaware, as part of a broad program to improve the financial returns of farmers.

Market surveys and consumer acceptance studies revealed that rapid deterioration of fresh mushrooms had generated high resistance on the part of produce men to handling the product, and that many housewives refused to purchase fresh mushrooms because they did not appear "clean".

Processing Method Developed

The three major demands from marketers were (1) packaging, (2) improved shelf life, and (3) cleaner or whiter mushrooms. On the basis of the survey, a research project was established — financed equally by the American Mushroom Institute, the State, and the Department of Agriculture — to develop the techniques which would satisfy market conditions. As a result of this work, suitable methods of washing, drying, packaging, and handling have been developed. Addition of a mild anti-oxidant to the washing solution has increased the shelf-life by retaining the natural whiteness of the mushrooms longer.

The experiments with packaging showed that cellulose acetate film provided the necessary properties, since it controlled the loss of moisture* and helped retain whiteness. Mushrooms are sorted and placed in small trays and

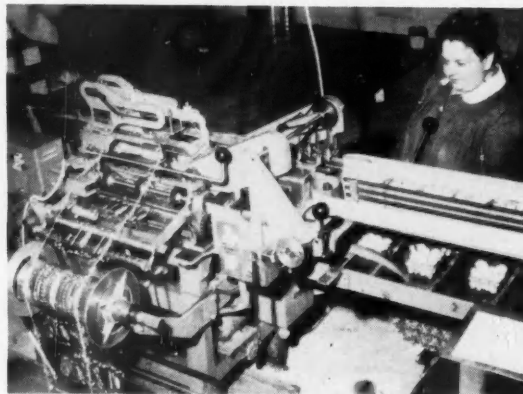
the film is overwrapped on standard commercial equipment.†

Growers who have followed the new method found their sales increased by about 20 per cent. Acceptance by tradespeople now is quite good. In addition to better shelf life, it has been found that packaging reduced retail spoilage losses by eliminating excessive consumer handling. In bulk displays of mushrooms, the first purchasers select all the large caps. Sales tests in Pittsburgh by the Pennsylvania State University showed that packaged mushrooms placed with meat displays increased sales by over 30 per cent — with a substantial rise in meat sales, as well. Packaging of mushrooms also permits geographical expansion of markets by prolonged shelf life.

Output Quadrupled

Mushroom growing is concentrated in the area around Philadelphia and Wilmington, with over 60 per cent of United States production originating there. Output has quadrupled over the 1930 production of 20 million pounds. The current crop brings in about \$20 million yearly and employs some 80,000 people.

About one-fourth of the U. S. output is sold fresh, the remainder processed as canned mushrooms and soup. Per capita annual consumption in the U. S. is less than .5 pound and fresh consumption only about .16 pound. By comparison, consumption of mushrooms in England is near one pound, a rate which researchers believe can be reached in the U. S.



MUSHROOMS in tapered plastic trays are machine overwrapped.

*Tests by the Du Pont Film Department showed that mushrooms, which are 90 per cent moisture, lose about 35 per cent of it in 24 hours on a dry rack.

†The two major growers packaging mushrooms use Du Pont Acetate film type 48.

Farmers Ask About

- Q: How much farm work does it take to "feed" the nation's insects?
A: Insects in the U. S. nullify the labor of at least 1,000,000 working men yearly, says the Louisiana State University; five pounds of vegetation are lost for every pound of insects.
* * * * *
- Q: How many insect pests are there in the United States?
A: Of the 86,000 named species of insects, about 10,000 are harmful.
* * * * *
- Q: Why should apples be cooled rapidly?
A: One day at 32°F is about equal to 10 days at 70°F, since apples respire 10 times faster at the higher temperature.
* * * * *
- Q: How many women are overweight in this country?
A: A report from Rutgers says some 15 million women are overweight.
* * * * *
- Q: Did corporate profits rise faster than farm income in 1957?
A: No, corporate profits were about five per cent below 1956, while farm income was up three per cent, according to government statistics.
* * * * *
- Q: Is it necessary to inoculate separated calves with rumen flora?
A: The USDA Research Center says flora will develop if isolation is not too rigid.
* * * * *
- Q: How is tobacco blue mold propagated?
A: It may survive in soil or be wind borne.
* * * * *
- Q: How does U. S. farm productivity compare with the rest of the world?
A: U. S. farmers (less than one per cent of world population) produce between two-fifths and one-half of the world's eggs, red meat, and milk.
* * * * *
- Q: Do fertilizer labels accurately describe the products?
A: Yes, according to tests by the Connecticut Agricultural Experiment Station, close to 90 per cent of the guarantees of composition were met or exceeded.
* * * * *
- Q: How much can milk yield be raised by more frequent milking?
A: In Kansas State College experiments, two-year-old cows gave 20 per cent more milk with three milkings, 35 per cent with four milkings, instead of two daily. The production differential declined with age.
* * * * *
- Q: Will chlorinated benzoic acids move into soil from treated plants?
A: In a USDA study, 2,3,6-trichlorobenzoic acid on stems and leaves of treated plants moved into soil through the root system and was absorbed by nearby plants.
* * * * *
- Q: Is this country's timber supply still being reduced?
A: No, for the first time wood is being grown faster than it is being removed, or destroyed by cutting, fire, insects, and diseases.
* * * * *
- Q: How does farm productivity compare with the prewar period?
A: Since 1940, per acre yield of corn has risen 56 per cent; wheat, 40 per cent; and cotton, 67 per cent.
* * * * *
- Q: At what normal speed do game birds fly?
A: Best information is that dove and plover fly 34 miles per hour; curlew, 38; quail, prairie chicken, ruffed grouse, jacksnipe, and mallard, 41; Canada geese and brant, 48; green-wing teal, 79; redhead, 82; blue-wing teal, 89; and canvasback, 94.
* * * * *
- Q: Is it true fish feel no pain when hooked?
A: Because of its poorly developed nervous system, a fish probably feels discomfort, rather than pain, according to Remington Arms Company.



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